

Natural / Synthetic
**Comments on the National Organic Standards Board
Clarification of the Definition of Synthetic (6/23/05)**

by Brian Baker on behalf of the
Organic Materials Review Institute
August 9, 2005

OMRI strongly supports the NOSB's efforts to bring clarity and consistency to the determination as to whether a substance is synthetic or non-synthetic. The clarification is vital to OMRI's ability to fulfill its mission. While most substances used in organic production are clearly non-synthetic, it is sometimes difficult to determine if a given source or manufacturing process results in a chemical reaction that would render a substance synthetic.

Producers, handlers, their suppliers, and their certifying agents must make decisions on a daily basis as to what complies and what does not comply. As a practical matter, they should be able to understand and agree about what is synthetic and what is non-synthetic without petitioning the NOSB, requesting the NOP's opinion, or filing a lawsuit. It is not practical or possible for the members of the NOSB or NOP staff to consider every brand name product that is presented to various accredited certifying agents in the course of reviewing farm plans.

OMRI endorses the framework that the NOSB has developed. The definition of extraction represents a step forward and the explanation of chemical changes is very useful. Our technical experts voiced some concern over the vagueness of the definition in the statute and rule, but realize that this is beyond the scope of the NOSB to change. As long as the NOSB can help all parties involved reach a common understanding in the face of that ambiguity, it is a step forward.

The NOSB should take into account that there are a number of substances that occur naturally that can also be commonly synthesized, either in natural-identical form or as a synthetic analog, and clearly identify approved sources when adding substances to the National List. At present, in order to know whether a particular input that does not appear on the National List is allowed, one must know the source and manufacturing process. Even when the source and manufacturing process are disclosed, it is often difficult to make a determination. OMRI asks the NOSB for guidance on potassium sulfate and amino acids / protein hydrolysates. The issue of side-reactions and the interpretation of annotations where a product is considered 'synthetic' should also be considered.

Extraction

The NOSB received a petition to allow synthetic amino acids in crop production. OMRI conducted a TAP review using glycine as the model amino acid. Some of the TAP reviewers considered glycine extracted from hydrolyzed soybeans to be non-synthetic, while others considered it synthetic due to a decomposition reaction.

OMRI lists a number of such products as allowed, but notes that there is a strongly held minority opinion that such products are synthetic and thus prohibited. Not all certifiers agree with OMRI's opinion that soybeans hydrolyzed by water and temperature (boiling) and / or by enzymes are non-synthetic and therefore allowed. However, OMRI considers soybean extracts hydrolyzed with strong acids (e.g. sulfuric acid) and bases (e.g. potassium hydroxide) to be synthetic,

particularly if the respective levels of sulfur or potash in the final product are elevated over the levels found in unprocessed soybeans.

OMRI has determined that lysophosphatidylethanolamine (LPE) is a natural compound extracted from eggs by enzymatic processes. Another amino acid considered non-synthetic and used in organic production is aminovinylglycine or AVG. The amino acid is produced by fermentation of a microbial fungus. AVG is used as a plant growth regulator and has been in an OMRI listed product as well as a WSDA organic program approved product since before the NOP rule was published.

On the other hand, glutamic acid and gamma amino-butyric acid (GABA) are also used as plant growth regulators. OMRI informed the manufacturer of a brand name product that contains those amino acids that the individual amino acids appear to be from sources that are either synthetic or produced by excluded methods.

OMRI asks the NOSB to specify which amino acids derived from plants, animals, and microorganisms are considered synthetic and which ones are considered non-synthetic extracts consistent with the examples above.

Side-Reactions

Because formulated brand name products seldom consist of a single ingredient, the blending of products that are generally allowed may result in a synthetic reaction and the creation of a synthetic substance that is not on the National List and therefore is prohibited. This is particularly problematic when the ingredients are themselves synthetic and on the National List.

For example, fish may be stabilized with phosphoric acid or sulfuric acid to lower the pH to 3.5. Sulfuric acid is reacted with rock phosphate to make superphosphate. When phosphoric acids is reacted with rock phosphate it makes triple superphosphate. Both superphosphate and triple superphosphate are prohibited under OFPA and the NOP. Putting rock phosphate into a reaction vessel with fish can buffer the acid and drive a reaction of the acid to create a more soluble phosphate. OMRI has determined that the synthetic side-reactions involved in rock phosphate-fish blends involves a reaction that yields superphosphate or triple superphosphate depending on the acid used.

Phosphoric acid stabilized fish will react with potassium hydroxide extracted kelp or humic acid to yield potassium phosphate. OMRI has established limits on humic acid to require a minimum of 1% humic acid and a ratio of at least 3:1 technical humic acids as reported under the California method to potash expressed as K_2O . The limit was established based on standard industry practices and widely accepted laboratory methods. See Appendix B for the full text of OMRI's policy for determining if humic acid derivatives are extracted or fortified.

A substance produced by the chemical reaction of two natural substances is synthetic and is therefore prohibited if not on the National List. Various soluble non-synthetic substances on the prohibited non-synthetics list (allowed with restriction) are known to react with one another in solution. Examples appear in the appendix on potassium sulfate.

Plant / animal substances may be chemically changed by the extraction reaction. For example, aquatic plants is prepared for use as foliar fertilizer by being dried and crushed, frozen and macerated, hydrolyzed by neutral hot-water treatment, hydrolyzed in an acid solution, hydrolyzed in an alkali solution, or processed by some chemical combination. Some of the extractions could be considered non-synthetic after reviewing the clarification from the NOSB, while others are clearly synthetic.

The NOSB voted in April 1995 that non-synthetic aquatic plant products, including those produced by neutral hydrolysis, were commercially available and that synthetic ones should not be added to the National List. The NOSB then voted in November 1995 that aquatic plant products that are alkali extracted are synthetic, and recommended that aquatic plants that are chemically changed by the reaction be added to the National List.

OMRI supports the NOSB crops committee recommendation to review the categories of aquatic plants, humic acid derivatives, and liquid fish products, and request the TAP reviews consider the consequences of blending ingredients in product formulation, and propose appropriate restrictions on blending. OMRI suggests that the NOSB and NOP consider inserting language to specify the limiting nature of the annotations in the introduction of the National List. Another approach that might merit consideration would be to structure the National List to list the reactants rather than the products of the reaction with well-defined limitations on the use of the reactants. For example, phosphoric acid and potassium hydroxide could be listed as crop production aids for use to stabilize fish products and hydrolyze aquatic plant products, respectively.

Crystallization

Various substances produced by crystallizing salt water have long been considered non-synthetic, such as sodium chloride (table salt) from evaporated seawater, calcium chloride from briny wells, and potassium sulfate obtained from evaporated Great Salt Lake water. However, all of these substances can also be synthesized by various processes. Organic farmers have long used potassium sulfate as a fertilizer. Certifiers have historically not accepted all sources of potassium sulfate, because it can be manufactured by a variety of different processes. Potassium sulfate occurs in nature, but is not as common as potassium chloride, also known as muriate of potash. Some of those sources have been considered non-synthetic, while others have been considered synthetic. OMRI has identified eight different sources and manufacturing processes used to produce potassium sulfate. Two are generally accepted as non-synthetic, four are widely accepted as synthetic, and two could be reasonably decided either way. Appendix A provides a summary of these eight different sources of potassium sulfate. We would like the NOSB to either confirm OMRI's opinion or clarify whether each of the following processes are synthetic or non-synthetic.

Synthetics used in Livestock Production

Some of the substances that appear on the National List as synthetic under 205.603 are also available from non-synthetic sources. In particular, vitamins can be extracted from agricultural products and nutrient minerals can be produced from mined sources. An increasing number of vitamins are produced the fermentation of genetically engineered organisms or by excluded methods, and are no longer being synthesized in the strict sense. Oxytocin is another item that

occurs in nature but also is synthesized, as noted in the TAP review. Other items on the National List appear to be available from non-synthetic as well as synthetic sources. In addition, a number of items that may be considered non-synthetic might also have synthetic analogs, similar to those found in crop production and processing.

Synthetics used in Processing

OMRI has commented several times on the use of synthetic substances in organic food processing. We understand that changes are expected, but look again for clarity and consistency.

We concur with the NOSB's conclusion that the reaction of two substances that are allowed as non-organic ingredients creates a new substance that itself must appear on the National List. Such a reaction is not considered 'processing' in the meaning of the term. Specifically, sodium or potassium lactate formed by the reaction of lactic acid and either potassium or sodium hydroxide is chemical synthesis, not processing. A separate petition, TAP review, recommendation and notification is needed for sodium or potassium lactate to be allowed in organic food processing.

As with crops and livestock, a number of substances can come from synthetic or nonsynthetic sources, depending on source and manufacturing process. OMRI's experts have some differences of opinion about what was considered synthetic might be eligible for reclassification as non-synthetic. There is broad agreement that at least some of the items that the NOSB voted to be synthetic would be eligible for reclassification if the NOSB clarification is followed. In addition, have the distinction of some forms being considered 'agricultural' and some forms considered non-agricultural synthetic. The distinctions between "bleached" and "unbleached" lecithin are not clear cut, as there are many grades of lecithin, and a better identification of forms is warranted. NOSB should consider revisiting these substances during the sunset review in order to designate which sources may be nonsynthetic and listed in 205.605(a). OMRI recognizes that the agricultural / non-agricultural distinction is covered in a separate paper, and is not prepared to comment on it at the present time, other than to say that there is less agreement than with synthetic / non-synthetic.

OMRI has commented extensively on ion exchange and other forms of chemical processing. The subject of chemical processing does not appear to be addressed, but the precedent set by the NOSB is that filtering agents and ion exchange media need to be on the National List to be used in organic processing. In particular, the NOSB recommended the addition of activated carbon to the National List.

Conclusion

OMRI strongly supports the clarification offered by the Materials Committee and urges the NOSB to adopt the policy at this meeting. I also hope that the NOSB and NOP recognizes that the certifiers have relied on OMRI to establish many precedents based on the OFPA definition of what is synthetic and what is non-synthetic, and its technical expertise. If the NOSB and NOP interpret what is 'synthetic' differently from that established precedent or changes the identity of synthetic substances on the National List, OMRI hopes that there is ample opportunity for public notice and comment before that precedent is overturned.

Appendix A Sources of Potassium Sulfate

Natural Deposits

Arcanite is the single salt of K_2SO_4 . Deposits are rare, but are known to occur in nature in Orange County, CA, Carlsbad, NM, as well as in Namibia and Japan. The arcanite deposit in California is an impurity found in a tin mine near Santa Ana. There are no known commercial deposits of arcanite of sufficient quantity and purity that are used for fertilizer production.

GSL Process

Great Salt Lake North Arm Brines are evaporated in a network of ponds, yielding shoenite, kainite, epsomite, and halite. Schoenite is a double salt that has a structure of $K_2SO_4 \cdot MgSO_4 \cdot 6H_2O$. Kainite consists of KCl; epsomite is $MgSO_4 \cdot 6H_2O$ and halite is NaCl. The evaporated brines are crushed, impurities floated off, and the salts are leached. KCl is added and the salts crystallize. OMRI considers the spontaneous reconstitution of salts in solution and crystallization to be non-synthetic and therefore allowed.

Langbeinite Process

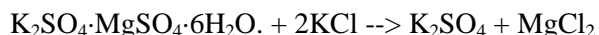
Langbeinite is a double salt that contains potassium sulfate and magnesium sulfate. Because the product contains proportionally as much magnesium as potash (K_2O) it is not always desirable in its mined form. Potassium sulfate can be produced from Langbeinite by the removal of magnesium sulfate through a variety of methods. One method commonly used to produce potassium sulfate involves the following reaction of Langbeinite and potassium chloride:



The reaction is similar to that of mined potassium chloride with mined sodium nitrate to produce synthetic potassium nitrate. OMRI regards the product of this manufacturing process to be synthetic and therefore prohibited. However, some experts consider the process to be extraction of a non-synthetic and therefore allowed.

SQM Process

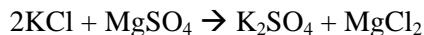
Underground brine in the Atacama desert is pumped to the surface into solar evaporative ponds. Mixed shoenite and sylvanite salts are harvested from the solar pond. Sylvite is predominantly potassium chloride (KCl). The shoenite is beneficiated by spontaneous endothermic reaction with the sylvite to make a highly pure potassium sulfate and magnesium chloride.



The K_2SO_4 is separated by a band filter and then dried. Next it is compacted, milled, rehydrated, redried, packed, and shipped. OMRI considers this process to be non-synthetic because the crystallization involves salts that are all in solution in the same brine source, but acknowledge that there is a difference of opinion and recognize that the process could be considered synthetic for the same reason as the Langbeinite. However, it clearly differs from the potassium nitrate process used by SQM because the sodium nitrate comes from a separate deposit of caliche ore rather than from the same brine that contains the mixed shoenite and sylvanite salts.

K+S Process 1

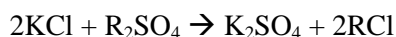
The Potash Import & Chemical Corporation (PICC) petitioned the NOSB to allow potassium sulfate made by this process in December 2001. The process described involves kieserite (MgSO_4) and sylvite (KCl) that are mined separate, purified, put in solution, disassociated by electrolysis, and crystallized at temperatures up to 120°C .



At the October 2002 meeting, the NOSB voted it to be synthetic and to not recommend that it be added to the National List. OMRI concurs with the NOSB's opinion. However, potassium sulfate made by this process is widely allowed for use in organic production several places outside the United States, including the European Union and Australia. (Konigsberger and Eriksson 1999; UC Davis, 2002).

K+S Process 2

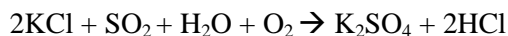
Kali und Salz (K+S) also has a patented process to produce potassium sulfate by passing potassium chloride over an anion exchange resin (R) laden with sulfate (Vajna and Peuschel, 1986).



The process also involves a synthetic reaction.

Hargreaves Process

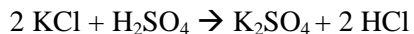
Sulfur is burned to form sulfur dioxide and is passed over potassium chloride to produce potassium sulfate and hydrochloric acid.



OMRI considers the process synthetic.

Mannheim Process

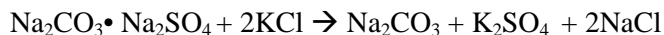
Potassium chloride is acidulated with sulfuric acid to make potassium sulfate and hydrochloric acid:



In OMRI's opinion, acidulation with sulfuric acid to makes this a synthetic product.

Trona Process

The Trona process is used reacts the double salt Burkite ($\text{Na}_2\text{CO}_3 \cdot \text{Na}_2\text{SO}_4$) with potassium chloride brine to produce potassium sulfate with sodium carbonate (Na_2CO_3) and common salt as the by-products.



Regarded by OMRI as a synthetic reaction.

Appendix B

OMRI's Humic Acid Derivative Policy

Humates may be extracted by potassium hydroxide to produce humic acids, provided that the amount of solvent used in the extraction process does not exceed the amount needed for extraction. Humic acid derivatives extracted with potassium hydroxide must have a ratio of at least 3:1 [% humic acid (as determined by the California Method) to % K₂O] where the humic acid value may be higher but the K₂O value may not be higher. The final product may not have more than 3% K₂O. For example, if a product has a final K₂O value of 3%, then the product must have at least 9% humic acid. Furthermore, in order to be listed as a humic acid derivative, products must contain a minimum of 1% or more humic acid (as determined by the California Method).

Humic acid products extracted with potassium hydroxide and then blended with other allowed or regulated ingredients may be placed in Unresolved status pending further policy development. KOH-extracted humic acid derivative products blended with fish products stabilized with a synthetic acid must meet requirements stated in the most current *OMRI Generic Materials List* for fish products, multi-ingredient. Contact OMRI for more information.

From the OMRI Operating Manual, 2002: p. 17.

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